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Vaccination for the Prevention of Smallpox

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Medical Director of the Employees' Benefit Fund Committee of the American Telephone and Telegraph Company, The Western Union Telegraph Company, and The Western Electric Company

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This is one of a series of monthly bulletins on Hygiene, Sanitation, and the Prevention of Disease. It is suggested that the articles be kept for reference, as in this way a hand-book on the subject of Hygiene may be secured.

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Vaccination for the Prevention of Smallpox

By DR. ALVAH H. DOTY

Reference is constantly being made in the public press and other current literature to the use of vaccine, anti-toxin, and serum in connection with the prevention and treatment of disease. While the terms are more or less familiar to all the means by which these agents are obtained, the theory regarding their action and the results that are expected are not clear in the public mind.

Vaccination for the prevention of Smallpox is the protective measure of the above group best known and most commonly employed and will therefore be dealt with in this article. Similar preventive measures will subsequently be considered.

Many years before vaccination was thought of, a means of modifying Smallpox or rendering it mild known as "inoculation" was extensively practiced in the East, particularly in Constantinople. This was in active operation about 1700 and a century later was introduced into England. Inoculation consisted in obtaining fluid or lymph from the little vesicles which form during the early stage of the eruption of this disease and introducing it under the skin of those who desired or were forced to receive this form of protection. While Smallpox was produced in the one inoculated, it was usually of a very mild type, and protected against the danger of contracting the disease in the regular way with the possibility of causing a great disfigurement or a fatal result. It was found, however, that although inoculation extended protection in the way described, a person thus treated became a medium of infection and transmitted Smallpox to others, often in its severest form, and in England its further use was prohibited by an Act of Parliament in the early part of the last century.

Inoculation may appear to us an exceedingly drastic method of protection, but it must be remembered that at the period it was employed the public was almost helpless in preventing the ravages of Smallpox and were willing to take advantage of almost any measure which provided even partial defense against it. There is probably no subject the statistics of which are more voluminous and more convincing, than those which

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relate to the destruction which followed in the wake of this disease before vaccination was discovered, for one-tenth to one-half of all deaths which occurred were caused by Smallpox, and one-third of the number of babies born died from it within a year, and many of those who recovered were either made blind or otherwise disfigured. In 1734 two-thirds of the entire population of Greenland died from this disease, therefore, it is not strange that the public mind was constantly disturbed regarding the danger from this source.

During the latter part of the 18th century, Dr. Edward Jenner, a young English physician who had given this subject careful and exhaustive study, had learned of the tradition existing among employes of dairies that those whose hands became infected while milking cows having a disease known as "Cowpox," which caused an eruption about the udder or teats of the cow, were protected against Smallpox. It seems strange that this alleged immunity had not before received earnest attention, but the indifference of the public to traditions and the reticence on the part of dairy owners to furnish information which might unfavorably affect their business, may partly account for this; however, it did not escape the careful observation of Jenner who, for almost thirty years, investigated this subject and then having demonstrated satisfactorily to himself the protective power of the method afterwards known as "vaccination," he presented to the world a minute and extensive description of his work and his conclusions relative to this protective measure.

Jenner did not try to conceal his discovery, but freely discussed it and invited aid, but for a long time met with nothing but indifference and discouragement. Even Dr. John Hunter, one of the greatest physicians of his time and under whose care Jenner studied as a favorite pupil, was at first but little impressed with the importance of vaccination, although he frequently referred to it in his lectures. Still undaunted, Jenner continued his investigation and on May 14th, 1796, was allowed to "vaccinate" a boy eight years of age with some lymph or fluid taken from a vesicle on the hand of a dairy maid who had contracted the so-called "cowpox." In July of the same year this boy was inoculated with Smallpox in the manner already described and, as Jenner predicted, the latter disease did not occur. Jenner afterwards vaccinated others with similar successful results. The account of his discovery soon became known through the world and vaccination spread with great rapidity, being introduced into the United States about 1800.

Jenner believed that the protective power of "vaccination" depended upon the fact that the disease known as "cowpox" was really Smallpox in the cow, but the infection in passing through the system of this animal became greatly modified or changed in character, although it afforded protection against Smallpox when introduced into the human being. This belief is still maintained, although the practical disappearance of cowpox has made it impossible for the scientists of the present time to continue the investigation begun by Jenner.

It is reasonable to assume that the hands of the milker through cracks or minute openings in the skin became infected by contact with the vesicles on the udder or teats of the cow and that this infection upon entering the system provided protection against Smallpox, the original cause of the disease in the cow. Jenner very properly argued that the same result would be secured, but in a much more satisfactory, effective and practical manner if the contents of these vesicles were obtained in a more scientific way, in order that the lymph could be conveniently and at any time introduced under the skin of those who were to receive the benefits of this protection. This was done by opening the vesicles on the udder or teats of the cow and removing their contents on various articles possibly of ivory, glass, or quills, etc., from which it could easily be transferred to a scarified or exposed surface of the skin. This was the origin of vaccination. The lymph or virus, as it is called, is interchangeable between the cow and the human being, i. e., the lymph taken from the vesicles on the cow will successfully vaccinate a human being, and that removed from the human vesicle can be used for vaccinating the cow, or the virus may be transferred directly from one person to another. In this way the supply of vaccine matter may be perpetuated. A fresh supply has been obtained by inoculating cows with the lymph taken from the Smallpox vesicle. At the present day the supply is maintained by vaccinating young calves with the vaccine matter from other calves or from children. At the proper stage the lymph or fluid in the vesicles on the cleanly shaven abdomen of the calf is removed and taken to the laboratory, where it is examined to detect the presence of contaminating organisms and also carefully tested, the latter is then mixed with glycerine or some other agent placed in small vials and hermetically sealed and is then ready for use.

When a vaccination is successful or "takes" a very characteristic vesicle appears within a few days after the operation at the point of introduction of the virus; this passes through various stages, becomes dried and the scab afterwards drops off at varying periods, leaving a characteristic depression or scar which to those who are practically familiar with its appearance indicates the success of the vaccination.

Until about twenty years ago vaccination was performed chiefly by what is known as "arm to arm" vaccination. This consisted in taking lymph from the vaccine vesicle on the arm (or other part of the body) of a recently vaccinated healthy child and immediately transferring it to the scarified arm of the children or adults brought together for this purpose.

Another former method of vaccination consisted in collecting the scabs from the arms of children known or believed to be in good healthy condition, mixing it with glycerine or some other fluid and using it for vaccination. While these methods were very successful it was feared that they constituted a possible medium of transmitting diseases from one person to another, although the danger from this source is greatly ex-

aggerated; however, to prevent any possible danger in this way these methods of vaccination have been practically abandoned and the method just referred to has been substituted, that is, the virus is secured from calves in the manner already described.

Those who are practically familiar with vaccination recognize that it does not confer immunity or protection in every case; still, this in no way affects the inestimable value of this form of protection for, as a rule, it can be depended upon, if not always to prevent the disease at least to render it mild. In some instances the primary or first vaccination will protect throughout life, in other cases it may not insure immunity for more than two or three years; however, it is believed by those who are competent to judge, that if a person is successfully vaccinated in infancy and again about ten or twelve years of age, immunity is generally conferred throughout life. This course has been strictly followed in Germany and there is probably no country where fewer cases of Smallpox occur; however, it is generally believed that vaccination should be performed every seven to ten years. There is scientific evidence to support this view and it should be regarded as an extra precaution, particularly in the presence of an outbreak of Smallpox.

There are some who do not approve of vaccination, chiefly among those who have had little or no personal experience with this means of protection, some of whom it is alleged not only deliberately distort statistics relative to this subject to suit their purpose, but present all sorts of theories other than vaccination to account for the decline of Smallpox. While it is not the object of this article to discuss this point, it may be said that in the ranks of anti-vaccinationists there are found but few, if any, of the leading practical sanitarians of the day who, from long personal experience, know the value of vaccination as a protection against Smallpox.

Vaccination is often objected to on the ground that danger may follow its use. Unpleasant results rarely occur; when they do it is usually the result of carelessness or uncleanliness. These conditions also present themselves in instances where simple wounds are not properly protected.

For various reasons vaccination, although a simple operation, should be performed by physicians and not laymen, except in instances where emergencies exist; besides, those vaccinated should be kept under professional observation until the arm heals and the scab falls off. This is not only for the welfare of the person vaccinated, but also to determine if the vaccination proves successful.

In order to secure successful vaccination it is exceedingly important that great care be taken in the production of the lymph or virus. Vaccine matter is now prepared largely by state and municipal laboratories and free vaccination is generally preformed. This insures without expense the best virus and most effective means of performing the oper-

ation. Health authorities throughout the country should be equipped to offer free vaccination in order that it may be properly and fully carried out, and it should be without expense to the individual, for it is a general protective measure.

A very simple, practical and sanitary method of vaccination which is at present employed consists in the scarification of the skin with the point of a needle in order that too much blood may not be drawn, the lymph being transferred from the vial to the skin by wooden tooth picks, both the needle and picks having been purchased in unopened packages and therefore new and clean. *These are to be used but once and then thrown away.*

The character or appearance of a successful vaccination depends upon whether or not it is a *primary or a first vaccination, or a secondary or re-vaccination.* A primary vaccination may easily be detected by a white pearly ring which surrounds the vesicle in its early stage; this does not appear in the revaccination, the latter having no special characteristics, which as a rule a layman would recognize. It is to properly determine the success of this operation that the observation of a physician is necessary for, while a revaccination may be quite sore and painful and associated with considerable inflammation, it does not necessarily follow that it is successful or confers immunity; this is decided largely by the appearance of the scar. Many persons vaccinate themselves or members of their family, or after having been vaccinated by a physician, do not see him again in order that the result of the operation may be determined, and therefore cannot be sure that protection is conferred and may be susceptible to Smallpox. Therefore, it is necessary that the result of every vaccination should be examined by a physician.

The outside of the left arm is usually chosen for vaccination for, as a rule, it is used less than the right one, and therefore subjected to less movement. For appearance sake some are vaccinated on the leg, although this is less desirable. The local symptoms are apt to be more severe and locomotion is not infrequently interfered with.

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